represent the balance of gold lost or absorbed in other than monetary uses.

The scarcity of gold may be illustrated by the fact that if the entire world production since the discovery of America were cast into a cube its edges would measure only 38.5 feet. It might well be questioned whether this gold, considered merely as a metal characterized by certain properties, could be worth the toil and sacrifice required for its production; but as a basis of exchange, greatly facilitating the development of commerce among the peoples of the earth, its value to civilization exceeds all reckoning.

In spite of a superficial claim often made that gold does not pay its cost of production, it can hardly be doubted that United States gold production, amounting to more than $4,500,000,000 when reckoned roughly at $20 an ounce, must have been an important factor in assisting the development of other sources of national wealth. The British Empire production from the Transvaal (1901 to 1927), of more than 198,000,000 ounces; from Australasia, of more than 168,000,000 ounces; from Canada, of nearly 32,000,000 ounces; from India and Rhodesia, together, 32,000,000 ounces; and from other parts of the British Empire, of 12,000,000 ounces, amounting in all, since 1801, to 442,994,369 ounces, or about $9,000,000,000, should be reckoned an important factor in the prosperity of that empire.

During the first half of the nineteenth century nearly three times as much gold was produced in the fifth decade as in the first; yet the production of the first decade of the next half century was almost four times that of the preceding decade and nearly twice that of the first half of the nineteenth century. A gradual decline is noted during this half century up to the last decade, which showed an increase of 94 per cent. over the preceding decade. During the last half of the nineteenth century nine times as much gold was produced as during the first half. During the first decade of the twentieth century the average annual production increased over 8,000,000 ounces, or 81 per cent., over the preceding decade's production. The second decade showed an increase in average annual production of over 2,000,000 ounces, or 12 per cent., more than during the first decade.

In the world production of gold from 1493 to 1927, North America was the largest producing continent, contributing 281,056,639 ounces, or 28 per cent., with Africa a close second, contributing 270,127,146 ounces, or 27 per cent., of the world total. Australasia produced nearly 169,000,000 ounces, or 17 per cent.; South America nearly 125,000,000 ounces, or 12 per cent.; Asia 112,000,000 ounces, or 11 per cent., and Europe nearly 44,000,000 ounces, or 4 per cent.

THE ANNUAL EXHIBITION OF THE BRITISH PHYSICAL AND OPTICAL SOCIETIES

THE twentieth annual exhibition of the Physical and Optical Societies opened on January 7 at the Imperial College of Science and Technology, South Kensington.

The London *Times* gave the following description of the exhibition: There were two main sections devoted respectively to trade exhibits of electrical, optical and other physical apparatus, and to research and experiment, and smaller sections showing apparatus used for the teaching of physics in schools and universities, a group of historical exhibits and competitive exhibits made by apprentices and learners. The last of these was introduced this year for the first time. It is realized that scientific instruments are now used so extensively that the makers have had to turn to methods of mass production. No one man to-day makes a complete instrument, and there is a danger of skilled craftsmanship dying out. The new section had for its object the encouragement of craftsmanship, and the display represented the individual work of apprentices and learners employed by scientific instrument manufacturers who took part in the exhibition. The two classes included practical examples of electrical, optical, engineering and metal work, tool-making and pattern-making, and examples of designs, drawings or tracings for scientific instruments. Eight prizes were offered, and there were 50 entries.

All the leading makers of instruments and accessories contributed to the trade section, and the exhibits covered a very wide range. There were cameras and lenses, valves, microphones, thermometers, meters of many specialized types, accumulators, timing mechanisms, spectrographs, magnetic compasses, echo sounding machines, aircraft direction finders, a tobacco moisture tester, binoculars, telescopes, rain gauges, theodolites, electric furnaces and scores of other instruments and machines.

The research and experimental section was particularly attractive, though it is hoped that in future years its scope and utility will be further extended by the cooperation of fellows of the societies and others who may be able to contribute. Government institutions, such as the National Physical Laboratory, and the Royal Air Force Establishment, South Farnborough, sent exhibits. From the laboratory came a distant reading resistance thermometer outfit for cold storage work, experimental transmitting and receiving apparatus for ultra-short waves, apparatus for the measurement of the over-all performance of radio receivers and a method for indicating turbulence in airflow.

Exhibits of the research laboratories of the Gramo-

phone Company, Limited, and the Marconiphone Company, Limited, occupied a whole room. A model was shown of a photographic sound-recording system. The system comprises a glow lamp, the brilliance of which is modulated by speech currents from the studio microphone. A slit of light from this lamp, after traversing an optical system which reduces the image of the slit to the required dimensions, impinges on a reel of film and makes a record of the variable density type. Another H. M. V. exhibit showed a method of reproducing physically the conditions in record grooves of any desired type. The apparatus enables groove conditions to be magnified 400 times, and by its use the behavior of needles at various stages of wear and under any required groove conditions can be felt and examined at leisure. Among numerous exhibits from the research laboratories of the General Electric Company, Limited, was a model of a photo-electric street lighting unit, so designed that as daylight fails lamps are automatically illuminated. The apparatus is being tested practically in a street at Wembley. Another model illustrated a transmission tower testing plant for the load testing of overhead transmission of current—a topical exhibit in view of the proposals for the distribution of electricity by means of towers and cables. Other bodies represented in the section included the British Research Association for the Woollen and Worsted Industries, which has an instrument for measuring the thickness of fabrics, and the Gas Light and Coke Company, Limited.

The apparatus for the historical section of the exhibition was selected this year to illustrate experiments of historical importance on the determination of the mechanical equivalent of heat, and some points in the evolution of thermometers. The thermometers included reconstructions of the earliest known instruments for demonstrating the expansion of air by heat, the thermoscopes described by Philo of Byzantium (300 B. C.) and Hero of Alexandria. There was also a photograph of Galileo's thermoscope.

Three evening discourses were arranged in connection with the exhibition. Lord Rayleigh gave an address on "Iridescent colors in nature from the standpoint of physical optics"; Mr. S. G. Brown on "Gyro compasses for gunfire control," and Sir Ambrose Fleming on "The present and future of television."

THE FOREST SURVEY

THE U. S. Department of Agriculture has issued a statement announcing the promotion by the United States Forest Service of District Forester C. M. Granger, of the Pacific northwest district, to the position of head forest economist in charge of the nation-wide forest survey now being launched by the Forest Service.

The forest survey, authorized by the McSweeney-McNary Act of 1928, is one of the most important undertakings in the development of forestry thus far undertaken. It will be a comprehensive appraisal of existing forest supplies and conditions, growth and requirements, and of present and future trends, all of which, when properly coordinated, will constitute a fundamental and economically sound basis for determining federal, state and industrial forest policies and programs. Congress has authorized a federal contribution of $3,000,000 to the project. A small initial appropriation of $40,000 is available this year.

Success in developing the project will depend upon widespread cooperation with federal and state and industrial and other private agencies. Certain phases of the survey, such as the forest resource inventory and the study of growth, will be handled by the regional forest experiment stations under the general direction of Mr. Granger.

Because of its outstandingly complex and important forest problems, the Pacific northwest has been selected as the region for the beginning of intensive work. The Pacific northwest forest experiment station, of which T. T. Munger is director, has already commenced preliminary work. The study will be extended as rapidly as possible to other forest regions, and will eventually cover the entire United States.

Another step already taken is a canvass, in cooperation with the U. S. Bureau of the Census, of the wood requirements of the wood-using industries, as a part of the present and future wood requirements phase of the survey. Advance cooperative work also is being initiated in the Lake States region.

The agricultural appropriation bill now before the Congress carries an increase of $85,000 for the forest survey for the next fiscal year. It is planned to use $50,000 of this to expand the work in the Pacific northwest, $25,000 to initiate intensive work in the southern hardwood region and $10,000 for individual assignments.

Mr. Granger is a graduate in forestry of Michigan Agricultural College. He entered the Forest Service in 1907, serving successively as deputy supervisor, supervisor, and assistant district forester in charge of the offices of silviculture and of operation in the Rocky Mountain district. During the war he served with the Tenth Forestry Engineers, attaining the rank of major. In 1924 he became district forester of the Pacific northwest district. He will enter his new work with a wide experience in the development of silvicultural policies, management plans, fire protection plans and with a comprehensive understanding of the economic aspect of forestry.

Mr. Granger assumes his new duties immediately, with headquarters temporarily in Portland, Oregon.